International Polar Orbiter Processing Package (IPOPP) User's Guide

Version 1.6a

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International Polar Orbiter Processing Package (IPOPP)

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General

The NASA Goddard Space Flight Center's (GSFC) Direct Readout Laboratory (DRL), Code 606.3 developed this software for the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) In-Situ Ground System (NISGS) and the International Polar Orbiter Processing Package (IPOPP). The IPOPP package leverages NISGS technologies to maximize the utility of Earth science data for making real-time decisions by giving fast access to instrument data and derivative products from the Aqua and Terra missions and future NPP and NPOESS missions.

This software is provided to Alpha Testers under an Alpha test agreement and cannot be redistributed. Alpha testers should be aware that development of this preliminary software continues. The DRL welcomes feedback from Alpha testers as this software further evolves. Please direct any comments or questions regarding this software to:

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Purpose

This document provides instruction for installing and operating the IPOPP software. The installed system reads MODIS Level-0 Packet Files and generates Level-2 Products.

System Description

The complete IPOPP includes the Front End System (FES), the Data System (DS), and the Science Processing Algorithms (SPAs). See Figure 1. Additional information on IPOPP and its components is available at: http://directreadout.sci.gsfc.nasa.gov/index.cfm?section=technology&page=IPOPP

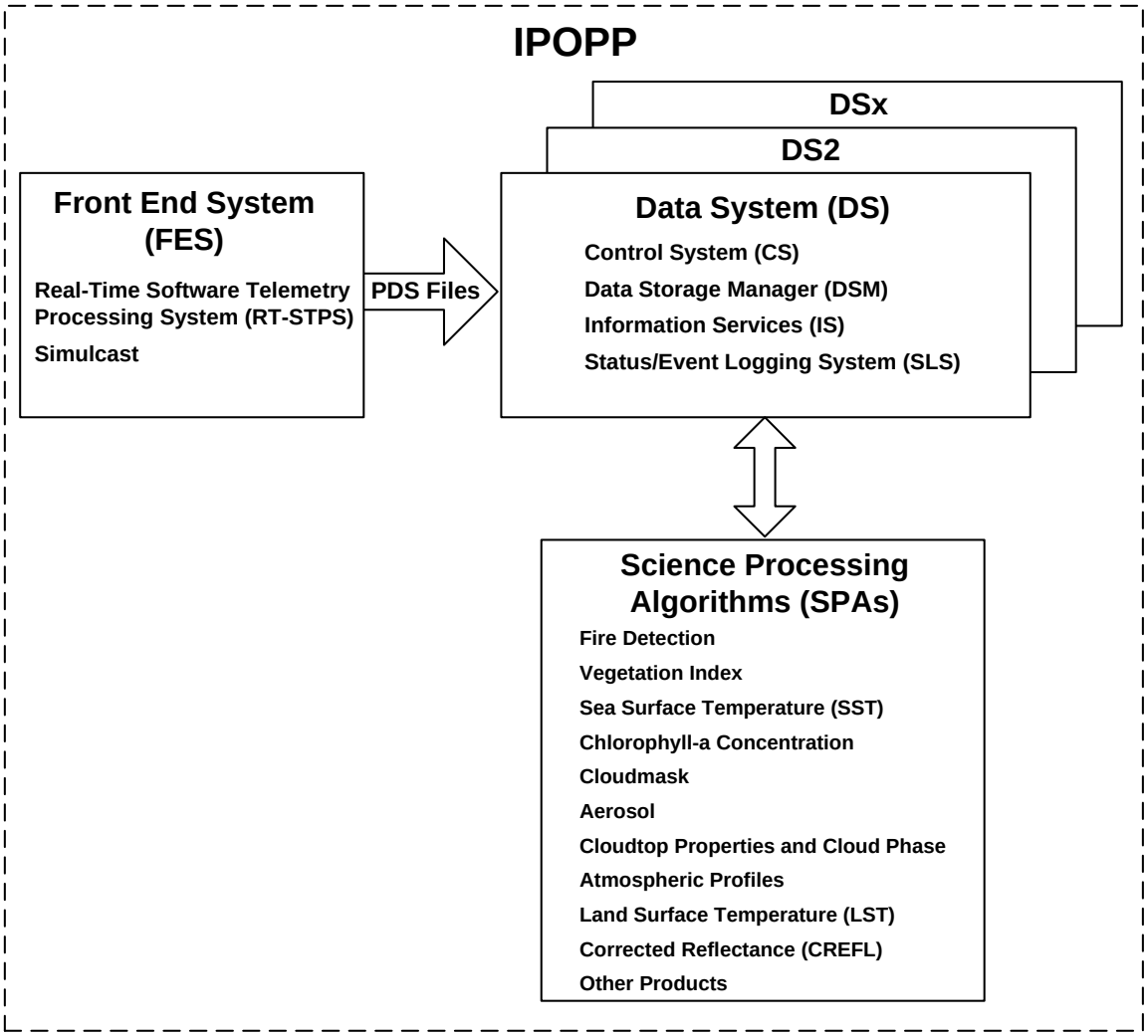


Figure 1. Major IPOPP Components

The FES contains the Real-time Software Telemetry Processing System (RT-STPS), to convert unsynchronized downlink data telemetry to Level-0 Production Data Set (PDS) and Construction Record (CSR) packet files, and the Simulcast package to view spacecraft imagery in near-real time. These two packages and their documentation are included in this distribution of the IPOPP Framework. See Appendix G, "IPOPP Software Package Overview." The packages and documentation are also available on the DRL Web Portal at http://directreadout.sci.gsfc.nasa.gov/.

The DS contains the Control System (CS), the Data Storage Manager (DSM), the Information Services (IS), and the Status/Event Logging System (SLS). The CS assembles the requisite input resources and schedules the execution of the SPAs. SPAs generate the Level-1 and Level-2 end products. A separate instance of the CS controls each algorithm. Appendix B, "SPA Execution List,"

lists the included SPAs. The functions of these SPAs are described in Appendix E, "Description of Science Processing Algorithms."

The DSM maintains a MySQL Database describing the location of data files and products, as well as metadata for the products. DSM agents move data among the several IPOPP components and store all products in the IS Data Repository.

The IS maintains a publicly accessible static subdirectory tree, the IS Data Repository, where products and data files are stored. The IS retrieves ancillary data files from the DRL or other remote locations and places them in this subdirectory. See Appendix F, "Information Services Repository Overview," for additional information.

The SLS manages and displays messages logged by the IPOPP components. Operation of the display client is described in Appendix D, "Status/Event Logging System."

Data flow among the IPOPP components is shown in Figure 2. The FES (the User's front end equivalent) places PDS and CSR files in a specified location where the DSM PdsMover agent discovers and copies them to the IS Repository while registering the files with the DSM.

Using File Transfer Protocol (FTP) or Hypertext Transfer Protocol (HTTP) as defined in configuration files, the IS retrieves ancillary data files from remote Internet sites, stores these data at specified locations in the IS Repository, and registers them with the DSM. The IS is initially configured to retrieve ancillary data from the DRL's IS Data Repository.

Each CS instance controls an SPA and is called a station. A CS station requests the requisite input products from the DSM and waits for the DSM Retriever agent to make the input products available before executing the SPA. The resulting output products are registered with the DSM.

The DSM Publisher agent copies registered products to the IS Data Repository, where they are publicly accessible and available for subsequent retrieval by the DSM Retriever agent for inputs to successor SPAs.

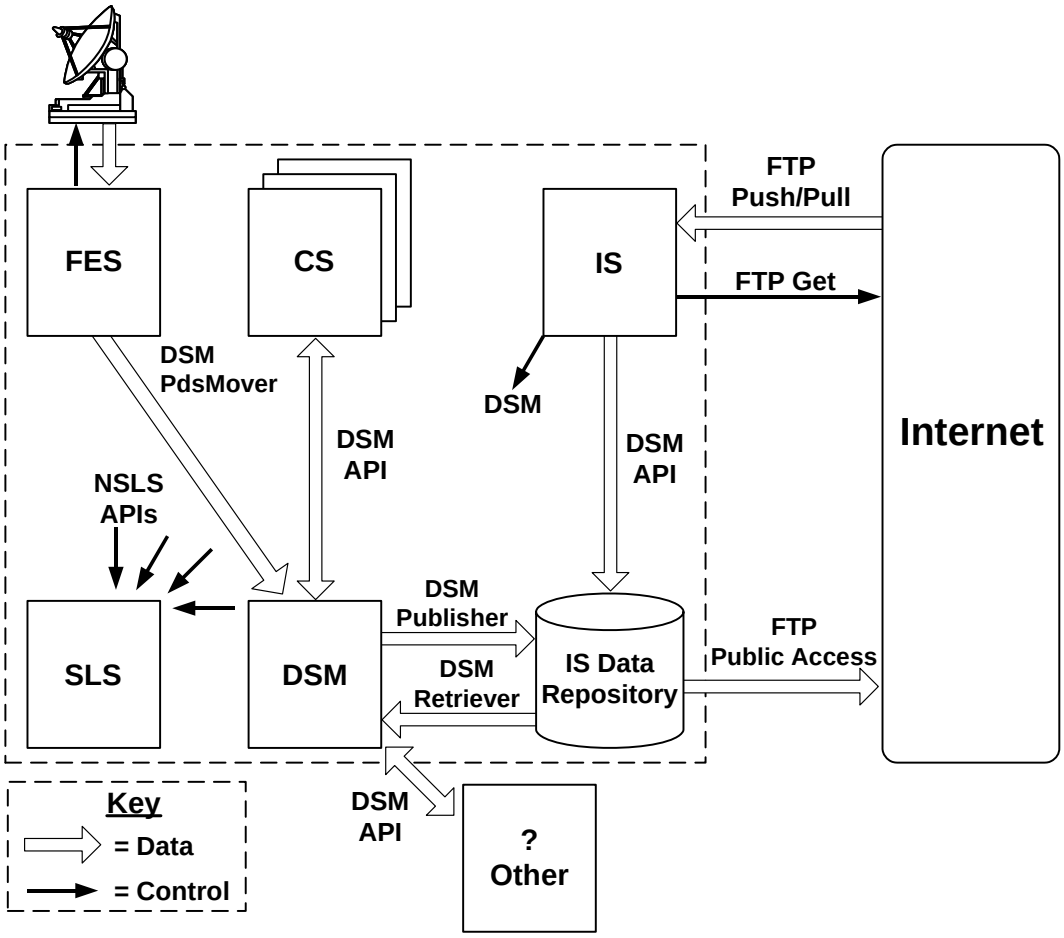


Figure 2. IPOPP Data Flow

IPOPP Installation

The provided scripts install the IPOPP on a single computer, or across multiple hosts. Each host in a multiple-host configuration is assigned a Front End System (FES), Data System (DS), or Information Services (IS) role and a specific set of IPOPP components.

a) The IS host contains the IS and includes the IS Repository, a DSM agent, MySQL, and may contain other components.

b) The FES host acquires packet data. It contains the RT-STPS to process packet data, a DSM agent, Simulcast, and may contain other components.

c) The DS host(s) runs the CS and SPAs and may contain other components.

The installation scripts provide single-host, two-host, or multiple-host configuration options. The specific components installed on each host depend on the configuration option. Installation options are depicted in Figure 3.

a) The single-host option installs all IPOPP components except RT-STPS on a single computer. Installation instructions are contained in the "Single-host Installation" section.

b) The two-host option installs the IPOPP in a two-host configuration, where the IS and DS reside on one host, and the FES resides on another host. Installation instructions are contained in the "Two-host Installation" section.

c) The multiple-host option installs the IPOPP in a multiple-host configuration, where the IS, FES and DS all reside on separate hosts. The DS resides on one or more hosts in a multiple-host installation. The user may install the DS on any number of hosts in order to accommodate the SPA processing load. Installation instructions are contained in the "Multiple-host Installation" section.

User Privilege Requirements

The first part of the following IPOPP installation options requires root privilege. The remainder of each installation option should be completed as a user with standard privileges who will operate the IPOPP. These instructions assume the environmental variable $HOME = /home/*userdirectory*, e.g., /home/ipopp.

Re-installation of IPOPP

The following instructions assume an original installation. If the IPOPP is being re-installed, first stop the IPOPP Services (see the "IPOPP Operation" section). Failure to halt the IPOPP Services prior to a new installation may leave rogue services running, and result in anomalous behavior.

Remove all files created by the previous installation process, including the drl/ and /raid/pub/* subdirectories.

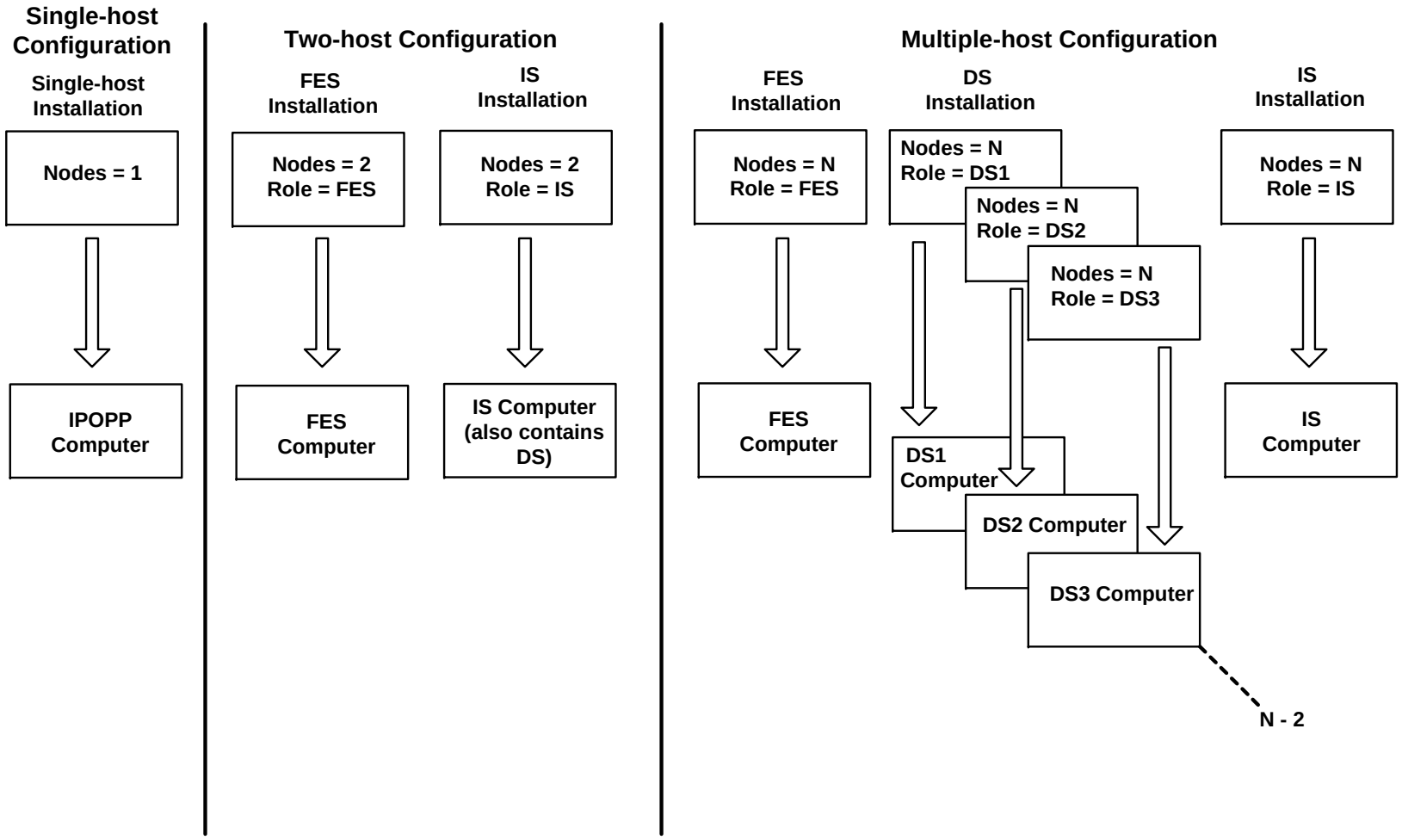


Figure 3. Installation Options

Single-host Installation

These instructions install the entire IPOPP on a single computer.

A system administrator with root privilege should complete instructions 1 through 5.

1. Verify that the target computer meets the system requirements in Appendix A, "System Requirements," before installing this IPOPP software package.

2. Log in as root.

3. MySQL must be installed and configured to execute when the operating system boots. MySQL must be executing with the root password set to"b28c935". To initially set the root password, enter:

   mysqladmin –u root password b28c935

   To change an existing root password, enter:

   mysqladmin –u root password –p<old_password> <b28c935>

4. Create the user account with standard privileges where the software will be installed and executed. This user will operate the IPOPP.

5. Create the /raid directory. The IPOPP user must own and have read/write access to the /raid subdirectory.

The IPOPP user should complete instructions 6 through 12.

6. Log in as the IPOPP user. The following instructions assume that $HOME is the user account subdirectory, and that this is the current subdirectory.

7. Copy the "JUMPSTART" directory and its contents from this IPOPP software package to the user account home directory. The name and location of this directory is important. The directory/filename path must be $HOME/JUMPSTART for the software to install.

8. Change the $HOME/JUMPSTART directory and contents permissions to owner rwx, group rx and other rx:

   chmod –R 755 $HOME/JUMPSTART

9. Verify that the computer system has the requisite software components installed. From the $HOME subdirectory:

   a) Make the $HOME/JUMPSTART the current directory:
      cd $HOME/JUMPSTART,

b) Run the script: ./system_test.sh. Correct any deficiencies noted by the script.

10. Install the IPOPP software. From the $HOME/JUMPSTART subdirectory:

    a) Make the $HOME/JUMPSTART the current directory:
    cd $HOME/JUMPSTART

    b) Run the script: ./setup.sh. Correct any deficiencies noted by the script.

    c) The script will ask if this is a 64-bit computer. Valid responses are Y or N and return.

    d) The script will prompt for the number of nodes. Enter: "1" and return.

    e) The script will install the software. The installation will take several minutes and display numerous messages. The final messages should be:

    "installed a single host configuration"

    "done"

    Error messages should be reported to the DRL.

11. Select the SPAs to execute by editing the

    $HOME/drl/ncs/configs/default_config.file.

    Un-comment each required SPA by removing the "#" from the line containing the SPA name. Do not remove the "#" from lines beginning as "# ---". See Appendix B, "Science Processing Algorithm Execution List."

12. Start the IPOPP Services as described under "Initial IPOPP Start" in the "IPOPP Operation" section.

Two-host Installation

These instructions install the IPOPP in a two-host configuration, where the IS and DS reside on one host, and the FES resides on another host. **The IS must be installed and started before installing and starting the FES.**

IS Installation

These instructions install the IS in a two-host configuration.

A system administrator with root privilege should complete instructions 1 through 8.

1. Verify that the target computer meets the system requirements in Appendix A, "System Requirements," before installing this IPOPP software package.

2. Log in as root.

3. Create the user account with standard privileges where the software will be installed and executed. This user will operate the IPOPP.

4. Copy the "JUMPSTART" directory and its contents from this IPOPP software package to the user account home directory. The name and location of this directory is important. The directory/filename path must be $HOME/JUMPSTART for the software to install.

5. Recursively change the ownership of the $HOME/JUMPSTART folder, so that the folder and its contents belong to the IPOPP user.

6. Create the /raid directory. The IPOPP user must own and have read/write access to the /raid subdirectory.

7. The vsftp demon must be previously installed on the IS computer. To configure vsftpd:

   a) Create a user account for user "nisgsftp" and set the password to "b28c935%". This account will be used by the IPOPP system to transfer data internally between the system components.

   b) Create a user account for user "incoming" and set the password as desired. This account can be used to copy PDS and CSR file pairs into IPOPP. See Appendix C, "Receiver Interface to IPOPP."

   c) Copy the ftp_conf.tar.gz file from $HOME/JUMPSTART/scripts/ftp_conf.tar.gz to /root/ftp_conf.tar.gz;

   d) Extract the files: tar –xzvpf ftp_conf.tar.gz;

   e) Change directories: cd /root/ftp_conf; and

f) Edit the setup_ftp.sh script. Change the variable "username" to the name of the IPOPP framework user account created in step 3 and the owner of the subdirectory created in step 4.

g) Execute the setup_ftp.sh script. If the script reports any errors, correct the problem and rerun the script. The script prints status messages and should conclude with:

"FTP configuration is complete.
If you are using a firewall, be sure to enable FTP access.
Also, be sure to enable ports 20, 21, and ports 41952-65535 for TCP."

Note that it is normal to receive a "FAILED" message when the script attempts to stop vsftpd the first time.

8. MySQL must be installed and configured to execute when the operating system boots. MySQL must be running and the root password should be set to "b28c935". To initially set the root password, enter:

   mysqladmin –u root password b28c935

   To change an existing root password, enter:

   mysqladmin –u root password –p<old_password> <new_password>

The IPOPP user should complete instructions 9 through 14.

9. Log in as the IPOPP user. The following assumes that $HOME is the user account subdirectory, and that this is the current subdirectory.

10. Change the $HOME/JUMPSTART directory and contents permissions to owner rwx, group rx and other rx:

    chmod –R 755 $HOME/JUMPSTART

11. Verify that the computer system has the requisite software components installed. From the $HOME subdirectory:

    a) Make the $HOME/JUMPSTART the current directory:
    cd $HOME/JUMPSTART,

    b) Run the script: ./system_test.sh. Correct any deficiencies noted by the script.

12. Install the IPOPP software. From the $HOME/JUMPSTART subdirectory:

    a) Make the $HOME/JUMPSTART the current directory:

    cd $HOME/JUMPSTART

b) Run the script: ./setup.sh. Correct any deficiencies noted by the script.

c) The script will ask if this is a 64-bit computer. Valid responses are Y or N and return.

d) The script will prompt for the number of nodes. Enter the total number (2) of hosts in the IPOPP and return.

e) The script will prompt for the role of this node. Enter "IS" and return.

f) The script will install the software. The installation will take several minutes and display numerous messages. The final messages should be:

"installed a N node configuration

configured for IS role

done"

Error messages should be reported to the DRL.

13. Select the SPAs to execute by editing the configuration file:

$HOME/drl/ncs/configs/default_config.file

Un-comment each required SPA by removing the "#" from the line containing the SPA name. Do not remove the "#" from lines beginning as "# ---". See Appendix B, "SPA Execution List."

14. Start the IPOPP Services as described under "Initial IPOPP Start" in the "IPOPP Operation" section.

FES Installation

These instructions install the FES in a two-host configuration. **The IS must be installed and started before installing and starting the FES.**

A system administrator with root privilege should complete instructions 1 through 4.

1. Verify that the target computer meets the system requirements in Appendix A, "System Requirements," before installing this IPOPP software package. The software requirements will be verified again in step 8.

2. Log in as root.

3. Create the user account with standard privileges where the software will be installed and executed. This user will operate the IPOPP.

4. Create the /raid directory. The IPOPP user must own and have read/write access to the /raid subdirectory.

The IPOPP user should complete instructions 5 through 10.

5. Log in as the IPOPP user. The following assumes that $HOME is the user account subdirectory, and that this is the current subdirectory.

6. Copy the "JUMPSTART" directory and its contents from this IPOPP software package to the user account home directory. The name and location of this directory is important. The directory/filename path must be $HOME/JUMPSTART for the software to install.

7. Change the $HOME/JUMPSTART directory and contents permissions to owner rwx, group rx and other rx:

   chmod –R 755 $HOME/JUMPSTART

8. Verify that the computer system has the requisite software components installed. From the $HOME subdirectory:
   a) Make the $HOME/JUMPSTART the current directory: cd $HOME/JUMPSTART,
   b) Run the script: ./system_test.sh. Correct any deficiencies noted by the script. "MySQL not found" messages may be ignored.

9. Install the IPOPP software. From the $HOME/JUMPSTART subdirectory:
   a) Make the $HOME/JUMPSTART the current directory: cd $HOME/JUMPSTART.
   b) Run the script: ./setup.sh. Correct any deficiencies noted by the script.
   c) The script will ask if this is a 64-bit computer. Valid responses are Y or N and return.
   d) The script will prompt for the number of nodes. Enter the total number (2) of hosts in the IPOPP and return.
   e) The script will prompt for the role of this node. Enter "NISFES" and return.
   f) The script will prompt for the hostname of the previously installed IS node. Be sure to enter the fully qualified domain name (e.g, myiscomputer.mydomainname.edu).
   g) The script will install the software. The installation will take several minutes and display numerous messages. The final messages should be:

"installed a N node configuration

configured for NISFES role

done"

Error messages should be reported to the DRL.

10. Start the IPOPP Services as described under "Initial IPOPP Start" in the "IPOPP Operation" section.

Multiple-host Installation

These instructions install the IPOPP in a multiple-host configuration, where the IS, FES and DS all reside on separate hosts. The DS resides on one or more hosts in a multiple-host installation. The user may install the DS on any number of hosts in order to accommodate the SPA processing load. **The IS must first be installed and started on one host before installing the FES and DS on separate hosts.**

IS Installation

These instructions install the IS in a multiple-host configuration.

A system administrator with root privilege should complete instructions 1 through 8.

1. Verify that the target computer meets the system requirements in Appendix A, "System Requirements," before installing this IPOPP software package.

2. Log in as root.

3. Create the user account with standard privileges where the software will be installed and executed. This user will operate the IPOPP.

4. Copy the "JUMPSTART" directory and its contents from this IPOPP software package to the user account home directory. The name and location of this directory is important. The directory/filename path must be $HOME/JUMPSTART for the software to install.

5. Recursively change the ownership of the $HOME/JUMPSTART folder, so that the folder and its contents belong to the IPOPP user.

6. Create the /raid directory. The IPOPP user must own and have read/write access to the /raid subdirectory.

7. The vsftp demon must be previously installed on the IS computer. To configure vsftpd:

a) Create a user account for user "nisgsftp" and set the password to "b28c935%". This account will be used by the IPOPP system to transfer data internally between the system components.

b) Create a user account for user "incoming" and set the password as desired. This account can be used to copy PDS and CSR file pairs into IPOPP. See Appendix C, "Receiver Interface to IPOPP."

c) Copy the ftp_conf.tar.gz file from $HOME/JUMPSTART/scripts/ftp_conf.tar.gz to /root/ftp_conf.tar.gz;

d) Extract the files: tar –xzvpf ftp_conf.tar.gz;

e) Change directories: cd /root/ftp_conf; and

f) Edit the setup_ftp.sh script. Change the variable "username" to the name of the IPOPP framework user account created in step 3 and the owner of the subdirectory created in step 4.

g) Execute the setup_ftp.sh script. If the script reports any errors, correct the problem and rerun the script. The script prints status messages and should conclude with:

"FTP configuration is complete.
If you are using a firewall, be sure to enable FTP access.
Also, be sure to enable ports 20, 21, and ports 41952-65535 for TCP."

Note that it is normal to receive a "FAILED" message when the script attempts to stop vsftpd the first time.

8. MySQL must be installed and configured to execute when the operating system boots. MySQL must be running and the root password should be set to "b28c935". To initially set the root password, enter:

   mysqladmin –u root password b28c935

   To change an existing root password, enter:

   mysqladmin –u root password –p<old_password> <new_password>

The IPOPP user should complete instructions 9 through 13.

9. Log in as the IPOPP user. The following assumes that $HOME is the user account subdirectory, and that this is the current subdirectory.

10. Change the $HOME/JUMPSTART directory and contents permissions to owner rwx, group rx and other rx:

    chmod –R 755 $HOME/JUMPSTART

11. Verify that the computer system has the requisite software components installed. From the $HOME subdirectory:

a) Make the $HOME/JUMPSTART the current directory: cd $HOME/JUMPSTART,

b) Run the script: ./system_test.sh. Correct any deficiencies noted by the script.

12. Install the IPOPP software. From the $HOME/JUMPSTART subdirectory:

a) Make the $HOME/JUMPSTART the current directory: cd $HOME/JUMPSTART,

b) Run the script: ./setup.sh. Correct any deficiencies noted by the script.

c) The script will ask if this is a 64-bit computer. Valid responses are Y or N and return.

d) The script will prompt for the number of nodes. Enter: the total number (3 or greater) of hosts in the IPOPP and return.

e) The script will prompt for the role of this node. Enter "IS" and return.

f) The script will install the software. The installation will take several minutes and display numerous messages. The final messages should be:

"installed a N node configuration

configured for IS role

done"

Error messages should be reported to the DRL.

13. Start the IPOPP Services as described under "Initial IPOPP Start" in the "IPOPP Operation" section.

FES Installation

These instructions install the FES in a multiple-host configuration. **The IS must first be installed and started on one host before installing the FES on a separate host.**

A system administrator with root privilege should complete instructions 1 through 4.

1. Verify that the target computer meets the system requirements in Appendix A, "System Requirements," before installing this IPOPP software package. The software requirements will be verified again in step 8.

2. Log in as root.

3. Create the user account with standard privileges where the software will be installed and executed. This user will operate the IPOPP.

4. Create the /raid directory. The IPOPP user must own and have read/write access to the /raid subdirectory.

The IPOPP user should complete instructions 5 through 10.

5. Log in as the IPOPP user. The following assumes that $HOME is the user account subdirectory, and that this is the current subdirectory.

6. Copy the "JUMPSTART" directory and its contents from this IPOPP software package to the user account home directory. The name and location of this directory is important. The directory/filename path must be $HOME/JUMPSTART for the software to install.

7. Change the $HOME/JUMPSTART directory and contents permissions to owner rwx, group rx and other rx:

   chmod –R 755 $HOME/JUMPSTART

8. Verify that the computer system has the requisite software components installed. From the $HOME subdirectory:

   a) Make the $HOME/JUMPSTART the current directory:
   cd $HOME/JUMPSTART,

   b) Run the script: ./system_test.sh. Correct any deficiencies noted by the script. "MySQL not found" messages may be ignored.

9. Install the IPOPP software. From the $HOME/JUMPSTART subdirectory:

   a) Make the $HOME/JUMPSTART the current directory:
   cd $HOME/JUMPSTART.

   b) Run the script: ./setup.sh. Correct any deficiencies noted by the script.

   c) The script will ask if this is a 64-bit computer. Valid responses are Y or N and return.

   d) The script will prompt for the number of nodes. Enter the total number of hosts in the IPOPP and return.

   e) The script will prompt for the role of this node. Enter "NISFES" and return.

   f) The script will prompt for the hostname of the previously installed IS node. Be sure to enter the fully qualified domain name (e.g, myiscomputer.mydomainname.edu).

g) The script will install the software. The installation will take several minutes and display numerous messages. The final messages should be:

"installed a N node configuration

configured for NISFES role

done"

Error messages should be reported to the DRL.

10. Start the IPOPP Services as described under "Initial IPOPP Start" in the "IPOPP Operation" section.

DS Installation

These instructions install the DS in a multiple-host configuration. **The IS must first be installed and started on one host before installing the DS on a separate host.** The following installation procedures must be completed for each DS host.

A system administrator with root privilege should complete instructions 1 through 4.

1. Verify that the target computer meets the system requirements in Appendix A, "System Requirements," before installing this IPOPP software package.

2. Log in as root.

3. Create the user account with standard privileges where the software will be installed and executed. This user will operate the IPOPP.

4. Create the /raid directory. The IPOPP user must own the /raid directory.

The IPOPP user should complete instructions 5 through 11.

5. Log in as the IPOPP user. The following assumes that $HOME is the user account subdirectory, and that this is the current subdirectory.

6. Copy the "JUMPSTART" directory and its contents from this IPOPP software package to the user account home directory. The name and location of this directory is important. The directory/filename path must be $HOME/JUMPSTART for the software to install.

7. Change the $HOME/JUMPSTART directory and contents permissions to owner rwx, group rx and other rx:

   chmod –R 755 $HOME/JUMPSTART

8. Verify that the computer system has the requisite software components installed. From the $HOME subdirectory:

   a) Make the $HOME/JUMPSTART the current directory:
   cd $HOME/JUMPSTART,

   b) Run the script: ./system_test.sh. Correct any deficiencies noted by the script. "MySQL not found" messages may be ignored.

9. Install the NISGS software. From the $HOME/JUMPSTART subdirectory:

   a) Make the $HOME/JUMPSTART the current directory:
   cd $HOME/JUMPSTART,

   b) Run the script: ./setup.sh. Correct any deficiencies noted by the script,

   c) The script will ask if this is a 64-bit computer. Valid responses are Y or N and return.

   d) The script will prompt for the number of nodes. Enter: the total number of hosts in the IPOPP and return.

   e) The script will prompt for the N of this node. Enter "NISDSn", where "n" is a unique integer 1,2,3,…, and return.

   f) The script will install the software. The installation will take several minutes and display numerous messages. The final messages should be:

      "installed a N node configuration

      configured for NISDSn role

      done"

      Error messages should be reported to the DRL.

10. Select the SPAs to execute by editing the $HOME/drl/ncs/configs/default_config.file.

    Un-comment each required SPA by removing the "#" from the line containing the SPA name. Do not remove the "#" from lines beginning as "# ---". See Appendix B, "SPA Execution List," for sample configuration files for a multiple-host installation.

11. Start the IPOPP Services as described under "Initial IPOPP Start" in the "IPOPP Operation" section.

IPOPP Operation

The following instructions for starting, halting and determining the status of the IPOPP should be executed from the $HOME/drl subdirectory. Where the IPOPP

is distributed across multiple hosts, the IS host should be started first, and then the remaining hosts. The IS host must have Internet access to the DRL. The MySQL Server and the SLS Server reside on the IS host, and SPAs are run on the DS computers.

NOTE: If the DSM Service is halted on a two-host or multiple-host installation, first stop and start IPOPP Services on the IS host. Then stop and start the IPOPP Services on the remaining hosts.

Initial IPOPP Start

On multiple-host configurations, the IS host should be started first. The IPOPP should run for about 30 minutes before starting product generation (see step 3) to allow initial retrieval of ancillary files and to reduce the number of transient errors displayed by the SLS Client.

1. Optionally, start the SLS Client to view the IPOPP status and event messages. The SLS resides on the IS host. Enter:

   $HOME/drl/nsls/bin/nsls-console.sh &

   and choose "localhost:3500" from the "SLS Server Selection" pulldown menu. Push "select". Set the client to real-time (live) mode after it connects to the SLS server. See Appendix D, "Status/Event Logging System."

   The client will initially be unable to connect to the server until the remaining services are started in step 2; the "connection refused" message is normal.

2. Start the IPOPP Services:

   $HOME/drl/tools/services.sh start

   "Network Unreachable" or other transient error messages may be written to the SLS Client until the IPOPP Services completely initialize.

3. To start product generation, transfer PDS and CSR file pairs to /raid/dsm/nisfes_data on the FES host. See Appendix C, "Receiver Interface to IPOPP." After two minutes, the IPOPP will move the files to, and begin storing products in, the IS Repository. See Appendix F, "Information Services (IS) Repository Overview. "

IPOPP Stop

On multiple-host configurations, the IPOPP on the IS host should be halted first. Halt the IPOPP Services by entering:

$HOME/drl/tools/services.sh stop

IPOPP Restart

1. If any of the following conditions exist:

a) the MySQL database has been damaged;

b) the IPOPP was halted for an extended period; or

c) the CS configuration file (see Figure B-1 for an example configuration file) has been modified;

then stop the IPOPP Services and clear product registration from the database. First, make this script executable and run the script:

chmod +x $HOME/drl /dsm/bin/erase_database.sh
$HOME/drl /dsm/bin/erase_database.sh,

then enter this line (the backslash is a line continuation and is not typed):

```
mysql  --user=dsm  --password=b28c935 DSM < \
 $HOME/drl/dsm/database/delete_products.sql
```

2. Start the IPOPP Services:

   $HOME/drl /tools/services.sh start

IPOPP Status

To determine the status of the IPOPP services and SPAs, enter the following command. It lists any IPOPP services or SPAs unexpectedly halted:

$HOME/drl /tools/system_status.sh

If all of the IPOPP services and SPAs are running normally, nothing will be listed.

Halting the IPOPP Services or SPAs by other than the specified procedures can cause "rogue" IPOPP processes to escape the normal process controls, resulting in anomalous and difficult-to-diagnose IPOPP behavior. This script identifies apparent IPOPP Services not under proper services controls:

$HOME/drl/tools/check_services.sh

IPOPP Testing

Appendix C, "Receiver Interface to IPOPP," includes instruction for testing the IPOPP by manually inputting PDS and CSR files.

Diagnosing IPOPP Operational Errors

This section outlines procedures and resources for identifying problems resulting in the failure of the IPOPP to generate products. The IPOPP is assumed here to be correctly installed and that problems are not a consequence of installation misconfiguration or hardware failure. The general idea is to detect failures by observing the SLS Viewer or the absence of products or ancillary data, and by tracing the data flow, locate the relevant logs or diagnostic outputs. Figure 4, "DS Data Paths and Diagnostic Sources," shows the general data flow through the DS and lists the relevant logs or diagnostic sources in italics.

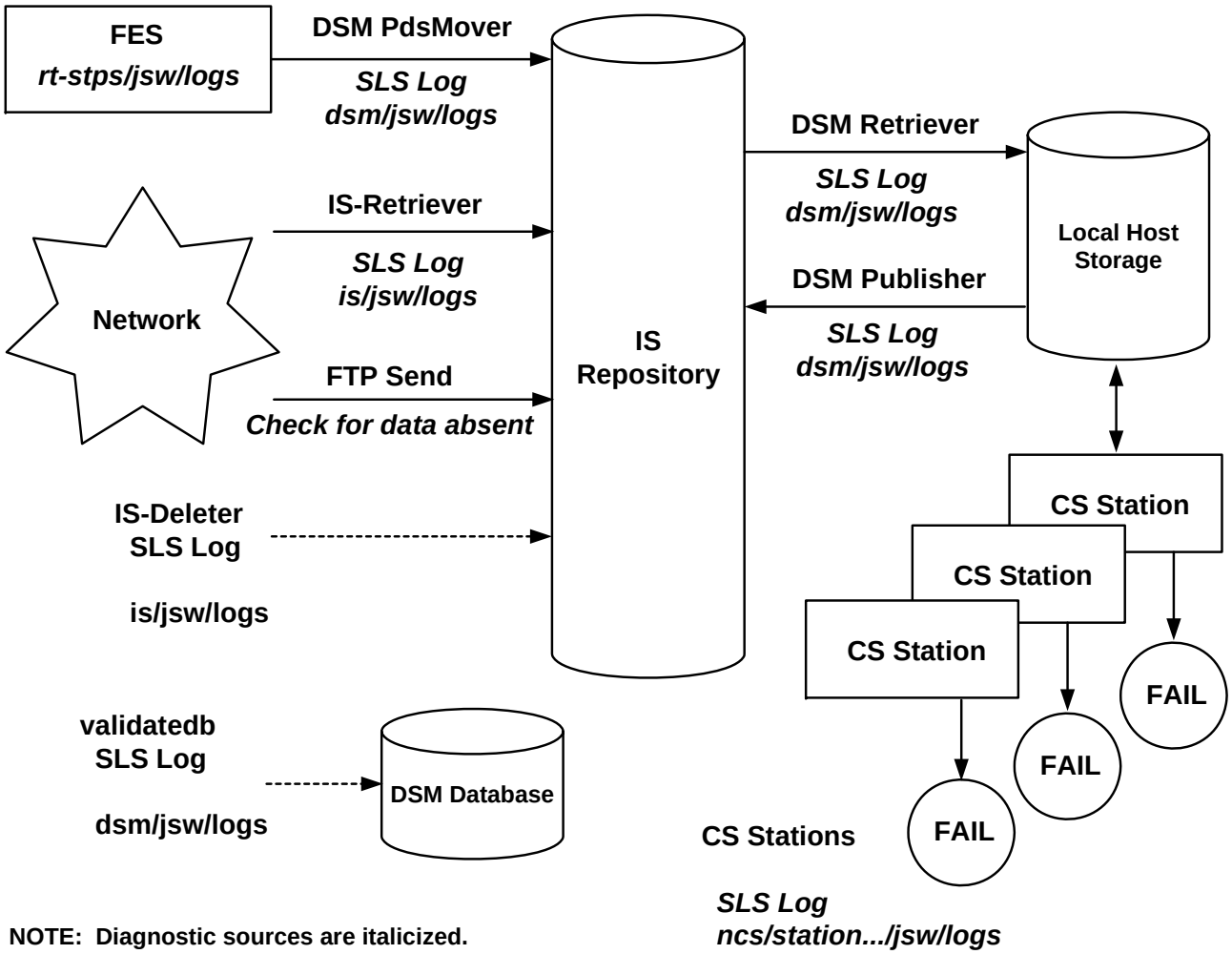


Figure 4. DS Paths and Diagnostic Sources

Status/Event Logging System

IPOPP Services report events to the Status/Event Logging System (SLS), where they can be viewed with the SLS client. (See Appendix D, "Status/Event Logging System.") Most events displayed originate from normal system operation. Warning events are displayed with a yellow background, and errors are displayed with a red background. Most warning and error events have system backtrace information, which can be viewed by selecting the button to the left of the event.

Java Service Wrapper Log Files

The Java Service Wrapper (JSW) framework controls IPOPP Services. The IPOPP Services are started or stopped, and their status displayed, through commands to the JSWs. The DSM, IS, and SLS Services subdirectories have jsw subdirectories containing their JSW configuration information. Each CS station controlling an SPA also has a JSW subdirectory.

If a service does not start, or if it stops immediately after being started, the log in the appropriate jsw/logs directory should be checked. See Figure 4.

Information Services (IS) Log Files

Ancillary data are sent by FTP to the IS Repository from remote sites, or acquired from remote sites by the IS-Retriever using http or ftp protocols. Files are periodically removed from the IS Repository by the IS-Deleter.

Ancillary data sent by FTP are not registered with the DSM and do not generate SLS messages. Failures to acquire these data are directly detected by their absence. These failures may be caused by problems at the remote site or network disruption, and are resolved through communication with contacts at the remote site.

The IS-Retriever may fail to acquire ancillary data from a remote site without logging an SLS error message because the retriever is not running or because a process was halted. These failures are detected directly by noting absence of the expected data. In either case, the SLS Viewer should be started and set to real-time mode, and the IS-Retriever restarted. The viewer should be checked to verify that the missing ancillary data are retrieved.

The IS-Retriever logs SLS error messages if there is a network disruption, the requested file is not on the remote site, or the file cannot be stored in the IS Repository subdirectory. The posting of some ancillary data at remote sites can delayed; to avoid attempted retrievals of files before they are generated, a date offset must be introduced in these cases.

The IS-Retriever and the IS-Deleter optionally write SLS messages to local logs. These logs may be helpful where the SLS Viewer is unavailable:

is/logs/retriever-nsls.log, and
is/logs/deleter-nsls.log.

The IS-Retriever and IS-Deleter JSWs also write logs useful for determining the cause of program startup or execution failure:

is/jsw/logs/is-retriever.log, and
is/jsw/logs/is-deleter.log.

Control System (CS) Log Files

The CS controls product generation. The CS assembles the requisite input resources and schedules the execution of Science Processing Algorithms (SPAs). SPAs generate the Level-1 and Level-2 end products from Level-0 products. A separate instance of the CS controls each algorithm. These CS stations are located in the subdirectory: ncs/stations.

Each CS station logs error messages to the SLS if the DSM fails to retrieve a requisite SPA input ancillary file or product, the SPA reports an error, or SPA execution fails because of an internal error. SLS messages are also optionally written to a file, by convention station.stationlog, in the station.

These errors by default also cause the CS to rename the RUN subdirectory in the CS station to FAIL and to retain this subdirectory. This FAIL subdirectory generally contains temporary files, program standard and error outputs used by the SPA, and can be useful for determining the cause of a failure.

The CS station JSWs also write to a log file in each station: jsw/logs. These logs may be useful in resolving issues where the station does not start or fails without writing SLS messages.

Noisy or short spacecraft passes often result in failure of the MODISL1DB_SPA. Generally, these errors can be ignored. Errors not attributable to bad or missing data should be reported to the DRL.

Data Storage Manager (DSM) Log Files

The DSM maintains a MySQL Database describing the location of data files and products. DSM agents move data among the several IPOPP components and store all products in the IS Data Repository. These agents log messages to the SLS and also write to log files in the dsm/jsw/logs subdirectory on the computers where they are executing.

The DSM PdsMover agent resides on the Front End System (FES) and moves PDS and CSR pass files from the FES to the IS Repository.

The DSM Retriever agent resides on computers running SPAs and makes IS Repository files available locally for input into the SPAs. The Retriever is not used where the NISGS is installed on a single computer.

The DSM Publisher resides on computers running SPAs and copies output files generated by the SPAs to the IS Repository. The Publisher is not used where the NISGS is installed on a single computer.

The Capsule agent resides on the computer holding the IS Repository and generates metadata for all product files in the IS Repository.

The validatedb agent periodically traverses the DSM database and deletes invalid references.

The MySQL Database maintains product and ancillary data locations and other information required by the DSM. Should the database be damaged, it can be repaired as follows:

1. Stop the IPOPP (See IPOPP Stop),
2. Run the command dsm/bin/rebuild_database.sh,
3. Start the IPOPP (See IPOPP Start).

Real-Time Software Telemetry Processing System (RT-STPS) Log Files

The RT-STPS reads Consultative Committee for Space Data Systems (CCSDS) packet data and writes Level-0 PDS and CSR files. The RT-STPS writes log messages to rt-stps/jsw/logs. It does not write messages to the SLS. The RT-STPS Viewer Utility displays the RT-STPS Servers status, and the Sender Utility can send test packet files to the server. A test file, "terracotta.dat" is included in this package. The Viewer and Sender utilities may be helpful diagnostic tools. RT-STPS is described in more detail in the DRL Document, "Real-time Software Telemetry Processing System (RT-STPS)," bundled with the RT-STPS software available for download at the DRL Web Portal at: http://directreadout.sci.gsfc.nasa.gov

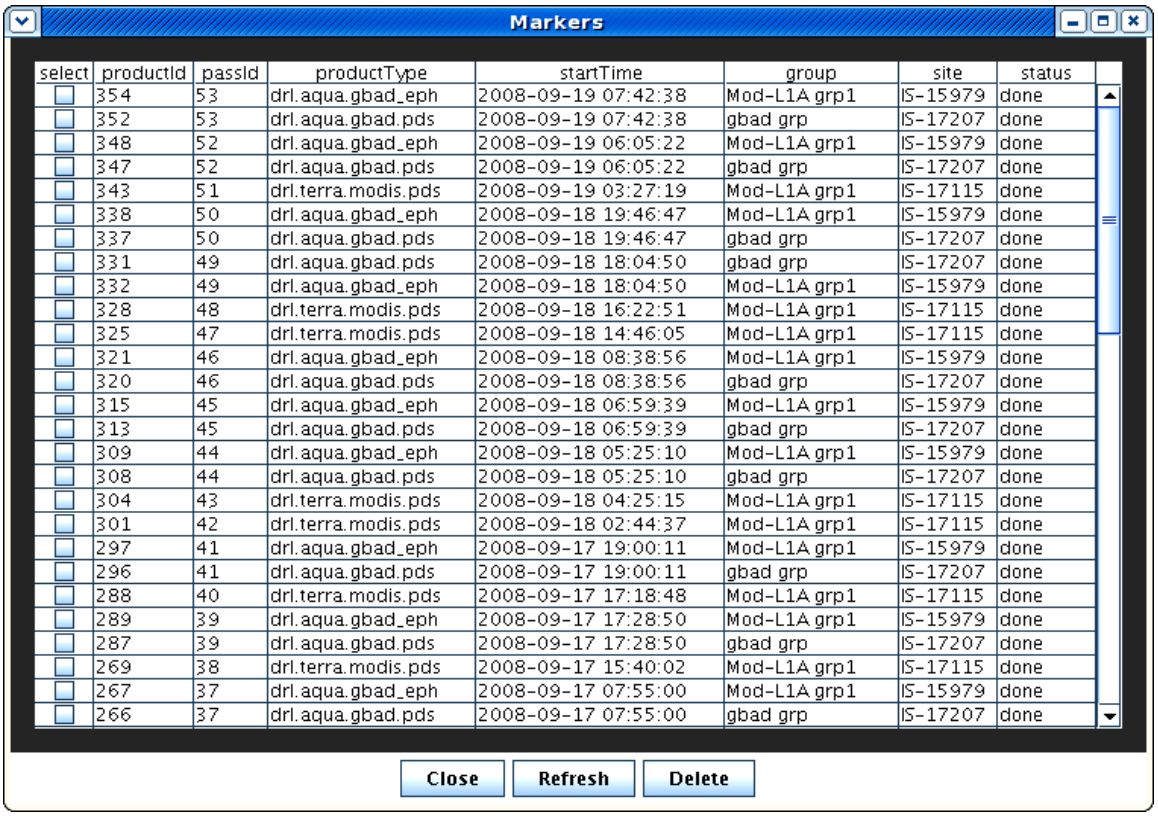
Restarting Data Processing After an Error

Generally, errors occurring while running an SPA will cause the CS station to abandon execution of the SPA for that pass, and the system will not automatically rerun the SPA on those data.

Failed SPA executions may be manually restarted using the Markers table tool. This tool can be launched by entering from the command line:

$HOME/drl/dsm/gui-scripts/markers.sh

causing the Markers Table window to appear, as depicted in Figure 5.



select	productId	passId	productType	startTime	group	site	status
☐	354	53	drl.aqua.gbad_eph	2008-09-19 07:42:38	Mod-L1A grp1	IS-15979	done
☐	352	53	drl.aqua.gbad.pds	2008-09-19 07:42:38	gbad grp	IS-17207	done
☐	348	52	drl.aqua.gbad_eph	2008-09-19 06:05:22	Mod-L1A grp1	IS-15979	done
☐	347	52	drl.aqua.gbad.pds	2008-09-19 06:05:22	gbad grp	IS-17207	done
☐	343	51	drl.terra.modis.pds	2008-09-19 03:27:19	Mod-L1A grp1	IS-17115	done
☐	338	50	drl.aqua.gbad_eph	2008-09-18 19:46:47	Mod-L1A grp1	IS-15979	done
☐	337	50	drl.aqua.gbad.pds	2008-09-18 19:46:47	gbad grp	IS-17207	done
☐	331	49	drl.aqua.gbad.pds	2008-09-18 18:04:50	gbad grp	IS-17207	done
☐	332	49	drl.aqua.gbad_eph	2008-09-18 18:04:50	Mod-L1A grp1	IS-15979	done
☐	328	48	drl.terra.modis.pds	2008-09-18 16:22:51	Mod-L1A grp1	IS-17115	done
☐	325	47	drl.terra.modis.pds	2008-09-18 14:46:05	Mod-L1A grp1	IS-17115	done
☐	321	46	drl.aqua.gbad_eph	2008-09-18 08:38:56	Mod-L1A grp1	IS-15979	done
☐	320	46	drl.aqua.gbad.pds	2008-09-18 08:38:56	gbad grp	IS-17207	done
☐	315	45	drl.aqua.gbad_eph	2008-09-18 06:59:39	Mod-L1A grp1	IS-15979	done
☐	313	45	drl.aqua.gbad.pds	2008-09-18 06:59:39	gbad grp	IS-17207	done
☐	309	44	drl.aqua.gbad_eph	2008-09-18 05:25:10	Mod-L1A grp1	IS-15979	done
☐	308	44	drl.aqua.gbad.pds	2008-09-18 05:25:10	gbad grp	IS-17207	done
☐	304	43	drl.terra.modis.pds	2008-09-18 04:25:15	Mod-L1A grp1	IS-17115	done
☐	301	42	drl.terra.modis.pds	2008-09-18 02:44:37	Mod-L1A grp1	IS-17115	done
☐	297	41	drl.aqua.gbad_eph	2008-09-17 19:00:11	Mod-L1A grp1	IS-15979	done
☐	296	41	drl.aqua.gbad.pds	2008-09-17 19:00:11	gbad grp	IS-17207	done
☐	288	40	drl.terra.modis.pds	2008-09-17 17:18:48	Mod-L1A grp1	IS-17115	done
☐	289	39	drl.aqua.gbad_eph	2008-09-17 17:28:50	Mod-L1A grp1	IS-15979	done
☐	287	39	drl.aqua.gbad.pds	2008-09-17 17:28:50	gbad grp	IS-17207	done
☐	269	38	drl.terra.modis.pds	2008-09-17 15:40:02	Mod-L1A grp1	IS-17115	done
☐	267	37	drl.aqua.gbad_eph	2008-09-17 07:55:00	Mod-L1A grp1	IS-15979	done
☐	266	37	drl.aqua.gbad.pds	2008-09-17 07:55:00	gbad grp	IS-17207	done

Figure 5. Markers Table

Each line in the Markers Table displays an attempted SPA execution. Failed SPA executions are indicated by the word "FAILED" in the "Status" column.

An SPA execution can be restarted by checking the corresponding select box and pushing the Delete Button. If the SLS is in live mode, new CS log messages should appear after a few seconds. The Refresh button updates the entire display to the current DSM status. Selecting an SPA has no effect on this action.

Installing New SPAs

The IPOPP installed by this package includes those SPAs currently distributed by the DRL. Newly released SPAs are publicly available on the DRL Web Portal. Instructions for installing new SPAs in an existing IPOPP follow.

1. Download the new SPA from the DRL Web Portal to the $HOME/*ipopp_user*/drl/SPA subdirectory.
   a) Log in to: http://directreadout.sci.gsfc.nasa.gov/ and select "DOWNLOADS" from the top menu, and
   b) Select "DRL Software/Algorithms List" to display a table of the currently released SPAs.

c) From the displayed table, select the SPA to be installed on the local IPOPP to display the Description Page for the selected SPA.

d) Push the "Download" button in the information page to select the Download Page, and

e) Select the compressed archive (tarball) files to download. The file name will be of the form: "*algorithm versionno*_SPA.tar.gz".

f) Read and accept or reject the presented software agreement. Questions or concerns should be directed as noted in the "General" section of this IPOPP User's Guide.

g) Selecting acceptance of the agreement invokes the Web browser download manager. Download the file to $HOME/*ipopp_user*/drl.

2. Remove any existing SPAs to be updated with new versions. New SPAs may be safely installed while the IPOPP is executing. If the new SPAs were not previously installed, this step should be bypassed. However, existing SPAs can only safely be updated when the current version has stopped generating products and has been removed.

   a) Product generation can be halted by stopping file transfers from the FES and waiting for the currently executing SPAs to complete.

      To stop file transfers from the FES, halt the PdsMover by entering the following command on a single-host system. On a two-host system enter the command on the IS Host, and on a multiple-host system enter the command from the FES host:

      $HOME/*ipopp_user*/drl/dsm/jsw/bin/pdsmover.sh stop

   b) When the IPOPP completes product generation and is quiescent, halt the IPOPP services by entering:

      $HOME/*ipopp_user*/drl/tools/services.sh stop

   c) Delete the existing SPA from the SPA subdirectory:

      rm –r $HOME/ipopp_user/drl/SPA/spa_subdirectory_name

3. Install the new or updated SPAs. The following procedures require the IPOPP MySQL Server to be running. On multiple-host systems, the FTP Server on the IS host must be running.

   a) Decompress and extract the contents from the archive. From the $HOME/drl subdirectory:

      tar xzf: *algorithm versionno*_SPA.tar.gz. This will create a new *algorithm* subdirectory in the $HOME/*ipopp_user*/drl/SPA directory.

b) Create CS Stations in the $HOME/*ipopp_user*/drl/ncs/stations subdirectory. From the $HOME/drl subdirectory, execute the install script in the new SPA subdirectory:

./$HOME/*ipopp_user*/drl/SPA/*spa_subdirectory_name*/NISGSinstall.sh

c) Enable the CS Stations. On each host selected to execute the new SPA, edit the:

$HOME/*ipopp_user*/drl/ncs/configs/default_config.file

and add the CS Station name. See Appendix B, "Science Processing Algorithm Execution List," for editing details.

4. Start the SPAs. From the $HOME/drl subdirectory, enter:

./tools/services.sh start.

This command starts all CS stations in the drl/ncs/configs/default_config.file not currently running.

5. Restart the PdsMover. If the PdsMover was halted in Step 2, restart it on the appropriate host:

$HOME/*ipopp_user*/drl/dsm/jsw/bin/pdsmover.sh start

Appendix A
System Requirements

This software, with all SPAs enabled, has been minimally tested to the following system requirements.

Hardware

The IPOPP, with all SPAs enabled, has been tested on a computer with this configuration. Eight GB of RAM is minimally required for acceptable performance; 16GB is highly recommended. Eight GB of RAM is required for 32-bit systems to prevent probable system failure. Separate physical disks for the operating system and data storage are also recommended. Performance on less capable systems may be improved by disabling unneeded SPAs. (See Appendix B, "Science Processing Algorithm Execution List.")

Processors:	Dual Quad Core AMD Opteron 2346 HE 1.8 GHZ
RAM:	8GB DDR 700MHZ minimum, 16GB recommended
Operating System Disks:	SATA 2 RAID-1 (two 500GB, 7200 r.p.m. disks)
Data Disks:	SATA 2 RAID-5 (four 500GB, 7200 r.p.m. disks) Mounted at /raid
Motherboard:	Tyan Thunder N3600m with VGA onboard

Operating Systems

The IPOPP has been tested under these operating systems. The IPOPP is expected, but not guaranteed, to run under other Linux distributions.

a) Fedora Linux x86_64 (tested with Fedora Core 6, Fedora Core 7, and Fedora 8);

b) CENTOS Linux 5.0 x86_64;

c) Open SUSE Linux 10.3 x86_64; and

d) Kubuntu Gutsy Gibbon 7.1.

System Time

Some IPOPP ancillary file retrievals and product generations are time-dependent; the system should use 24-hour UTC time and be synchronized through a Network Time Protocol (NTP) Server.

Required Software

The following software must be previously installed:

a) Sun Java Development Kit (JDK) 1.5 x86_64 (is missing from default installation of Fedora Linux, Centos, and SUSE Linux, all versions). Do not use the installed free software version;

b) MySQL Client and Server 5.0 or later (missing from default installation of Fedora Linux, Centos, SUSE Linux, all versions);

c) libXp 1.0 or later (missing from default installation of Fedora Linux, Centos, and SUSE Linux 10.3);

d) bash 3.2 or later (comes with Fedora Linux, Centos and SUSE Linux);

e) tcsh 6.1 or later (may be missing from Fedora Linux after version 7, missing from SUSE Linux 10.3);

f) bc 1.0 or later (may be missing from default installation of Fedora Linux, Centos, SUSE Linux, all versions);

g) ed 0.2 or later (may be missing from default installation of Fedora Linux, Centos and SUSE Linux, all versions);

h) libxcb 1.1 Fedora 8 and SUSE 10.3 only. Upgrade Fedora 8 from libxcb 1.03 to 1.1. Version 1.1 comes with SUSE Linux 10.3.

i) The SPAs require 32-bit support. Linux distributions not providing native 32-bit support require the installation of ia32libs. See Errata.

Network Firewall Configuration and Port Access

These TCP ports should be open on the IS host computer in multiple-host configurations:

a) Ports 20 and 21 for FTP,

b) Port 3306 for MySQL,

c) Ports 3500 through 3550 for Simulcast and SLS,

d) Ports 4900 through 4950 for DSM, and

e) Ports 49152 through 65535 for passive mode FTP.

Errata

On systems using Kubuntu 7.1, IPOPP multi-host installations require MySQL to listen on IP address 0.0.0.0 rather than the default 127.0.0.0. Modify the /etc/mysql/my.cnf file so that the bind-address parameter value is 0.0.0.0 as in this file fragment:

```
# Instead of skip-networking the default is now to listen only on
# localhost which is more compatible and is not less secure.
# bind-address          = 127.0.0.1
bind-address            = 0.0.0.0
```

On systems using Kubuntu 7.1, the following message may appear once the user runs the FTP setup script:

./setup_ftp.sh: line 104: chkconfig: command not found

The user should ignore this message. Kubuntu does not use the chkconfig command, and the script is merely reporting this to the user. Other Ubuntus are expected to exhibit similar behavior.

When performing two-host or multiple-host installations on Kubuntu or Ubuntu systems, double-check that the nisgsftp password is correct before installing the FES and/or the DS(s). When the nisgsftp account is created with the GUI tool, password expiration is set by default. If the nisgsftp account attempts to connect via FTP prior to the password being reset, the connection will fail.

Some systems, particularly those running the Linux Kernel 2.6.22 and older with 4GB or more of memory installed, may halt under heavy SPA workloads. Where this is a problem, use conservative boot parameters. On the kernel command line set:

apm=off acpi=off mce=off

Under heavy SPA workloads, some machines with the Nvidia chipset installed on the motherboard may suddenly lose external network connectivity. This problem may be verified by searching the output of the dmesg command for numerous entries like this:

eth0: too many iterations (6) in nv_nic_irq.

To correct this problem on Fedora systems, add this line to the /etc/modprobe.conf file and reboot:

options forcedeth max_interrupt_work=128

To correct this problem on Kubuntu 7.1, add this line to the /etc/modprobe.d/options file:

options forcedeth max_interrupt_work=128, and

Add the following line to the /etc/rc.local file and reboot:

rmmod forcedeth && modprobe forcedeth && /etc/init.d/networking restart

On systems using SUSE Linux 10.3, the following line must be added to the .profile in order for the nsls-console.sh program to function:

export LIBXCB_ALLOW_SLOPPY_LOCK=1

Once this line has been added, and prior to starting IPOPP services, log out and log back in, to ensure that the shell has the proper environment setting.

For systems running Fedora 8 Linux, it will also be necessary to upgrade libxcb from Version 1.03 to Version 1.1, as well as adding the line to bash_profile.

Linux distributions not providing native 32-bit support require the installation of ia32libs. Do not install ia32libs on systems providing native support.

Systems known to provide native 32-bit support:

a) Redhat Enterprise,

b) Redhat Fedora,

c) Suse,

d) Centos.

Systems known not to provide native 32-bit support and require the installation of ia32libs:

a) Ubuntu,

b) Kubuntu.

Appendix B
Science Processing Algorithm Execution List

The drl/ncs/configs/default_config.file configuration file lists those Science Processing Algorithms (SPAs) selected for execution. This file is used for controlling the IPOPP Services and obtaining their status. An example for a three-host configuration is shown in Figures B-1 and B-2. Text between a "#" and the following end-of-line is considered a comment. Text delimited by white space is considered the name of an SPA.

The default_config.file, as in the example, initially only enables the Level-0 to Level-1 SPAs (l0l1aqua, l0l1terra, l1atob and gbad); all Level-2 SPAs are commented and therefore disabled.

To enable an existing SPA, edit the configuration file and remove the "#" preceding the SPA name. Do not remove the "#" from lines beginning as "# ---". Remember that each enabled SPA increases the system resource load.

To add a new SPA, locate the CS Station subdirectory found in the $HOME/*ipopp_user/drl*/SPA/*SPA_NAME*/station/ subdirectory of the newly installed SPA. Add this name to the default_config.file. The name should follow after the names of requisite ancestor products.

Generally the configuration file groups products in the required order of generation to make dependencies more obvious; dependencies are also noted in comments. In the example:

```
# ---Normalized Difference Vegetation Index
# ---(ndvievi requires crefl, geotiff requires firedetect)
#ndvievi
#ndvi-geotiff
```

the ndvievi-geotiff product requires output from the ndvievi and firedetect products. The ndvievi product requires output from crefl. Level-0 and Level-1 product dependencies are not noted; these lower-level SPAs are enabled by default.

The single configuration file in a single-host and two-host configuration lists all the SPAs to be executed. The configuration file resides on the DS host in a two-host configuration.

Figures B-1 and B-2 provide a recommended load distribution for multiple-host configurations. Further instruction for larger configurations will be provided as new SPAs become available.

The currently available SPAs are included in this IPOPP software package and are listed in the configuration file. New and updated SPAs and instruction for adding them to an existing IPOPP installation will be publicly available from the DRL Web Portal at: http://directreadout.sci.gsfc.nasa.gov

```
# ---NCS Station Selection File
# ---Select Science Processing Algorithms (SPAs) by removing "#"
# ---Do not remove "#" from comment lines.

# ---MODISL1DB --- (Do not disable)
#l0l1aqua
l0l1terra
l1atob

# ---Ground Based Attitude Determination (Do not Disable) #gbad

# --- L2GEN Ocean Color
chlor_a
chlor_a-geotiff

# ---MODIS Corrected Reflectance
crefl

# --- MODIS Active Fire Product (MOD14)
#mod14
#fire-geotiff

# --- International MODIS/AIRS Processing Package # --- (uncomment IMAPP SPA and xxx-
geotiff files) #IMAPP IMAPP-Cloudtop aerosols-geotiff atmprofile-geotiff cloudmask-geotiff #ctp-
geotiff irphase-geotiff

# ---MODIS Land Surface Temperature (LST) # --- (lst-geotiff requires firedetect) #MODLST #lst-
geotiff

# ---Normalized Difference Vegetation Index # ---(ndvievi requires crefl, geotiff requires firedetect)
#ndvievi #ndvi-geotiff #evi-geotiff

# ---L2GEN Sea Surface Temperature
#sst
#sst-geotiff

# --- CREFL True Color (needs crefl)
creflrgb-geotiff
# ---(creflrgbfire-geotiff requires mod14) #creflrgbfire-geotiff

# --- MOD09 Surface Reflectance
mod09
```

Figure B-1. Example DS1 Configuration File

```
# ---NCS Station Selection File
# ---Select Science Processing Algorithms (SPAs) by removing "#"
# ---Do not remove "#" from comment lines.

# ---MODISL1DB --- (Do not disable)
l0l1aqua
#l0l1terra
#l1atob

# ---Ground Based Attitude Determination (Do not Disable) gbad

# --- L2GEN Ocean Color
#chlor_a
#chlor_a-geotiff

# ---MODIS Corrected Reflectance
#crefl

# --- MODIS Active Fire Product (MOD14)
mod14
fire-geotiff

# --- International MODIS/AIRS Processing Package # --- (uncomment IMAPP SPA and xxx-
geotiff files) IMAPP #IMAPP-Cloudtop #aerosols-geotiff #atmprofile-geotiff #cloudmask-geotiff
ctp-geotiff #irphase-geotiff

# ---MODIS Land Surface Temperature (LST) # --- (lst-geotiff requires firedetect) MODLST lst-
geotiff

# ---Normalized Difference Vegetation Index # ---(ndvievi requires crefl, geotiff requires firedetect)
ndvievi ndvi-geotiff evi-geotiff

# ---L2GEN Sea Surface Temperature
sst
sst-geotiff

# --- CREFL True Color (needs crefl)
#creflrgb-geotiff
# ---(creflrgbfire-geotiff requires mod14) creflrgbfire-geotiff

# --- MOD09 Surface Reflectance
#mod09
```

Figure B-2. Example DS2 Configuration File

Appendix C
Receiver Interface to IPOPP

The Production Data Set (PDS) (packet file and construction record) file pair(s) are entered into the IPOPP by placing them in the /raid/dsm/nisfes_data subdirectory on the Front End System (FES). The DSM PdsMover agent polls this subdirectory for Construction Record (CSR) files. When PdsMover finds a CSR file, it performs preliminary processing and validation before transferring the packet and CSR file pair to the IS Data Repository and registering the files with the DSM. If the validation or the transfer fails, then the files are moved to the /raid/dsm/nisfes_data/FAIL subdirectory. Generally, the receiving system places the files in the nisfes_data subdirectory.

The large packet file must be transferred to the /raid/dsm/nisfes_data subdirectory before the smaller CSR file is written to the same subdirectory. This order reduces the possibility of PdsMover transferring an incompletely written file.

Alternatively, the packet and CSR file pair may be copied in any order to /raid/dsm/nisfes_data as files named with suffixes other than PDS so that they are not recognized by PdsMover. The files can then be renamed with the proper suffixes.

To test the interface, first start the SLS to monitor the IPOPP. See Appendix E, "Status/Event Logging System." Then copy a packet and CSR file pair to nisfes_data/.

In more detail, the interface may be tested by manually copying a current Terra MODIS packet and CSR file pair from the DRL IS Data Repository to the local /raid/dsm/nisfes_data/ subdirectory. The Terra MODIS FTP URL is:

ftp://is.sci.gsfc.nasa.gov/gsfcdata/terra/modis/level0/

The rightmost numeric digit in PDS file names is a "1". The corresponding CSR file is identically named excepting the rightmost numeric digit is a "0". By example:

P0420064AAAAAAAAAAAAAA07317165921001.PDS is a MODIS packet file, and,

P0420064AAAAAAAAAAAAAA07317165921000.PDS is a MODIS CSR file.

An FTP transfer in the above order of similar files selected from the DRL repository to the FES /raid/dsm/nisfes_data subdirectory on a running IPOPP host starts product generation.

To generate Aqua Spacecraft products, the GBAD packet file and CSR file must be transferred before the MODIS packet file and CSR file, as in the following example:

ftp://is.sci.gsfc.nasa.gov/gsfcdata/aqua/gbad/

P1540957AAAAAAAAAAAAAA07318174251001.PDS
P1540957AAAAAAAAAAAAAA07318174251000.PDS

ftp://is.sci.gsfc.nasa.gov/gsfcdata/aqua/modis/level0/

P1540064AAAAAAAAAAAAAA07318174251001.PDS
P1540064AAAAAAAAAAAAAA07318174251000.PDS

Appendix D
Status/Event Logging System (SLS)

The Status/Event Logging System (SLS) logs status and event messages sent by the IPOPP components. It is the primary system monitoring and diagnostic tool and gives the first indication of system problems or anomalies. An example of the SLS Viewer is shown in Figure D-1

The SLS Viewer displays logged messages. Messages can be viewed in real time or replayed from a selected time span. Message filters allow the display of selected messages.

Informational messages are displayed over a white background. Warning message text is displayed over a yellow background and error messages are displayed over a red background.

Error messages also include backtrace text, which can be displayed or written to a file for further analysis. See Figure D-2.

To run the SLS Viewer, enter $HOME/drl/nsls/bin/nsls-console.sh. The following section describes the SLS Viewer functions in more detail.

NOTE: Do not select the Processing Monitor from the SLS Viewer "File" pull-down menu. This unsupported option is under development and may cause the viewer to fail.

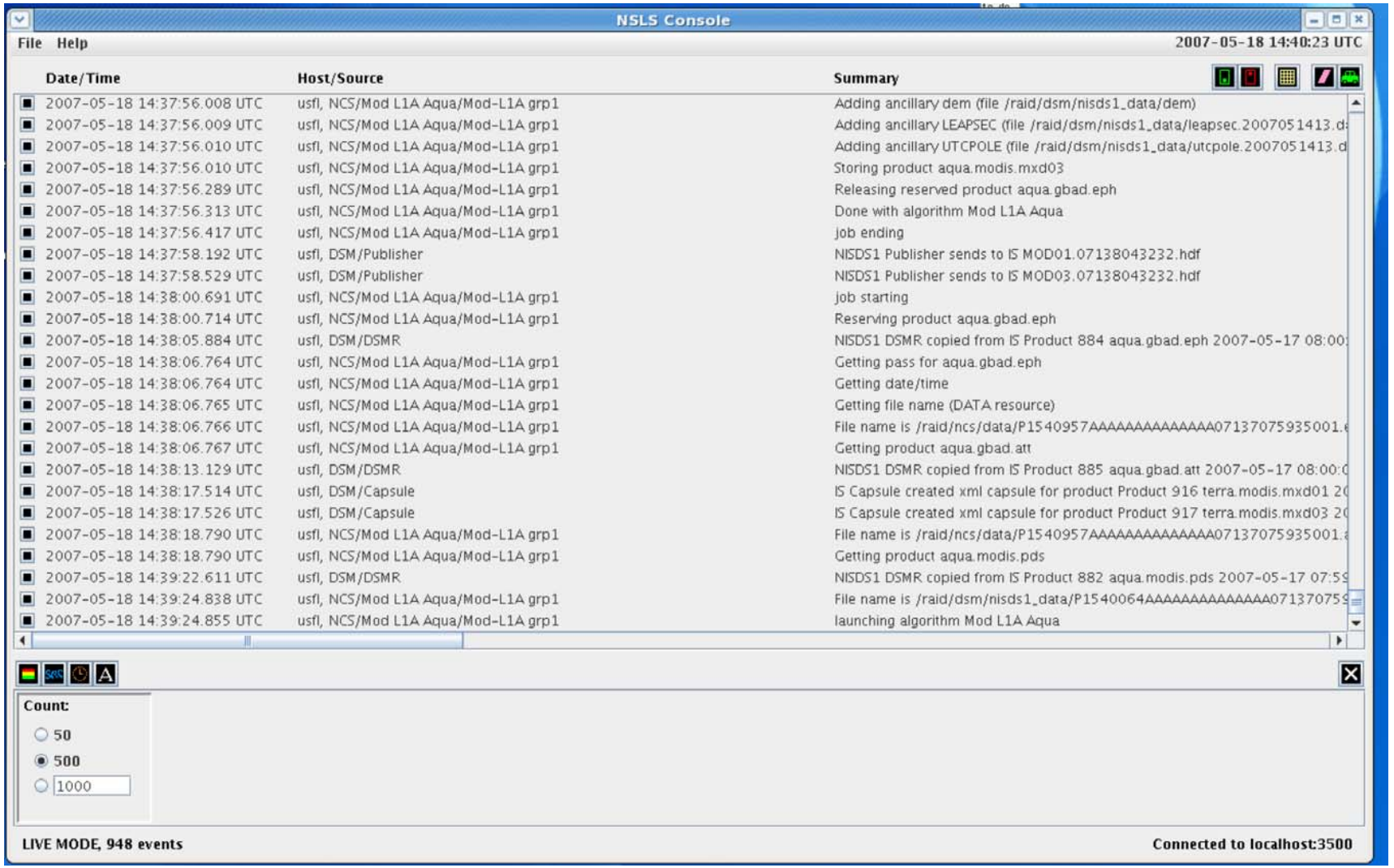


Figure D-1. SLS Console

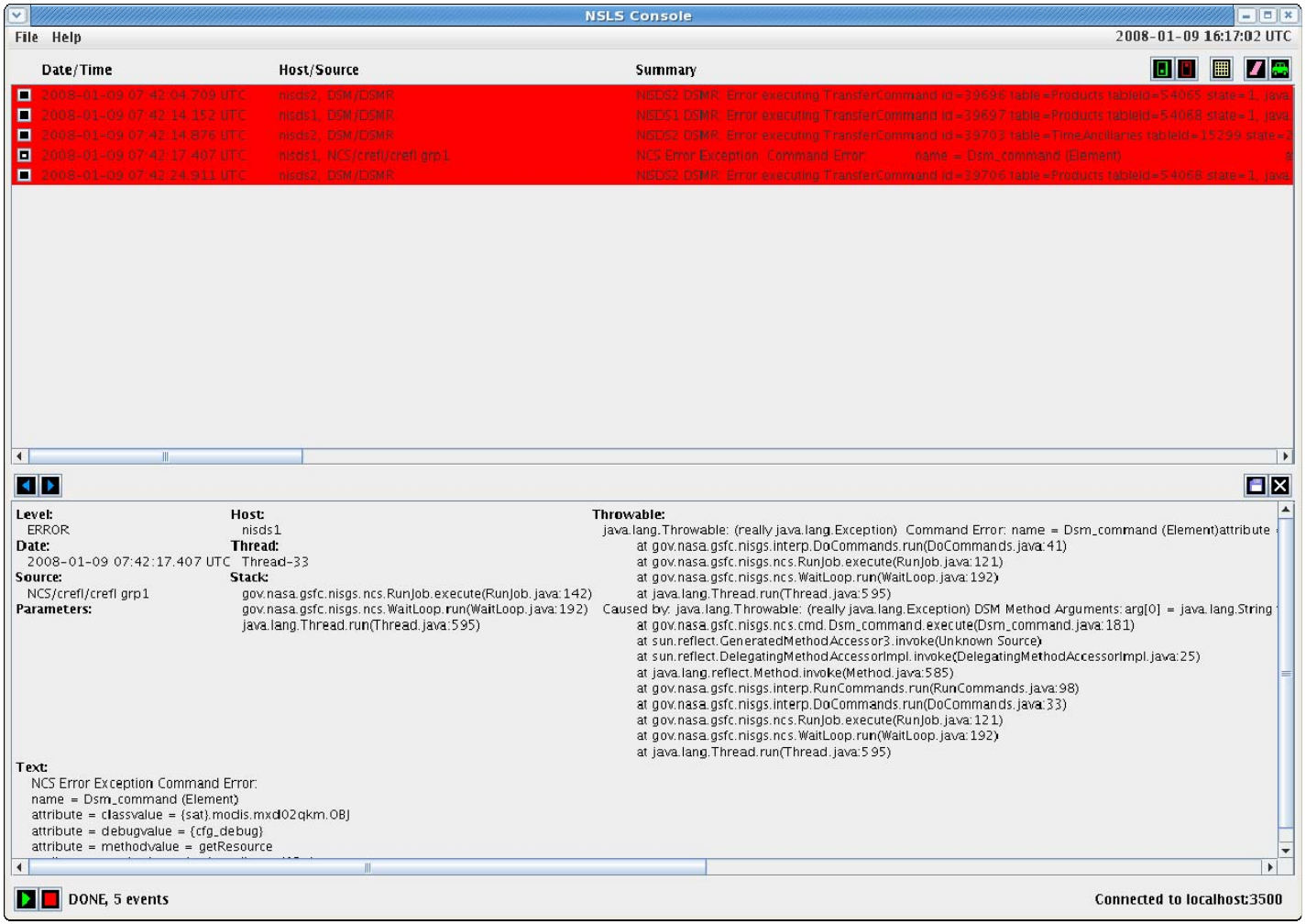


Figure D-2. Error Back Trace Text

The SLS Server Selection Window is invoked from the "file → Connect" dropdown menu to select the SLS Server to be displayed by the Console. See Figure D-3. The hostname:port may be entered by typing into the window or by choosing an entry from the dropdown menu. Generally, the selection should be "localhost:3500".

The "Select" button establishes the connection. The connection status is displayed in the lower right corner of the Console.

Figure D-3 Server Selection Window

The five Mode Control Buttons in the upper right hand corner of the display are shown in more detail in Figure D-4.

The Real-Time Mode Button displays messages as they are reported to the logger. The mode status is displayed in the lower left corner of the Console.

The Playback Mode Button allows messages to be displayed for a selected time span. This button opens the Playback Controls shown in Figure D-5. The mode status is displayed in the lower left corner of the Console.

The Show Filters Button forces Message Filters to be displayed if they are hidden.

The Erase Screen Button deletes displayed messages.

The Scroll Lock Button stops automatic message scrolling.

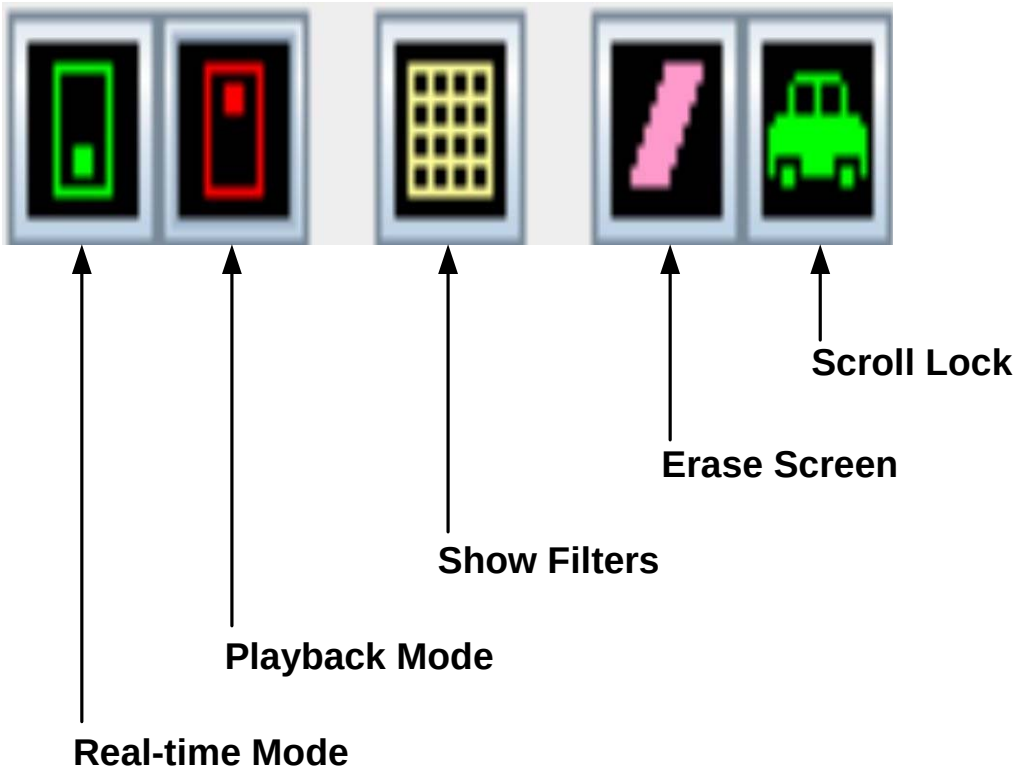


Figure D-4. Mode Control Buttons in Upper Right of Display

The Playback Control Buttons are displayed in the lower left window corner when the logger is in Playback Mode. See Figure D-5.

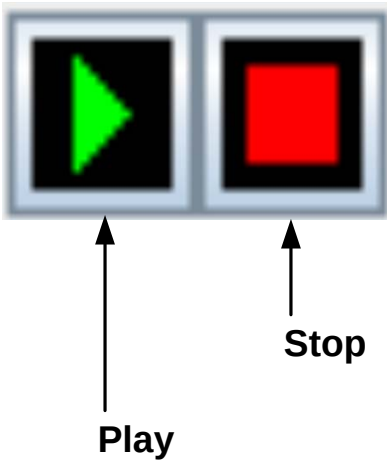


Figure D-5. Playback Controls

The four Message Filters serially select a subset of all messages for display. The filters are invoked by clicking on the buttons shown in Figure D-6. Each button opens a separate window where the selection criteria are specified.

The Level Filter allows message selection by Information, Warning, and Error messages levels.

The Source Filter allows selection of messages by IPOPP component origin. The DSM, CS, IS, RT-STPS, MMS and Simulcast (SC) may be specified.

The Date/Time Filter constrains the display of messages to a specifiable time span.

The Text Filter allows only those messages containing a specifiable text string to be displayed.

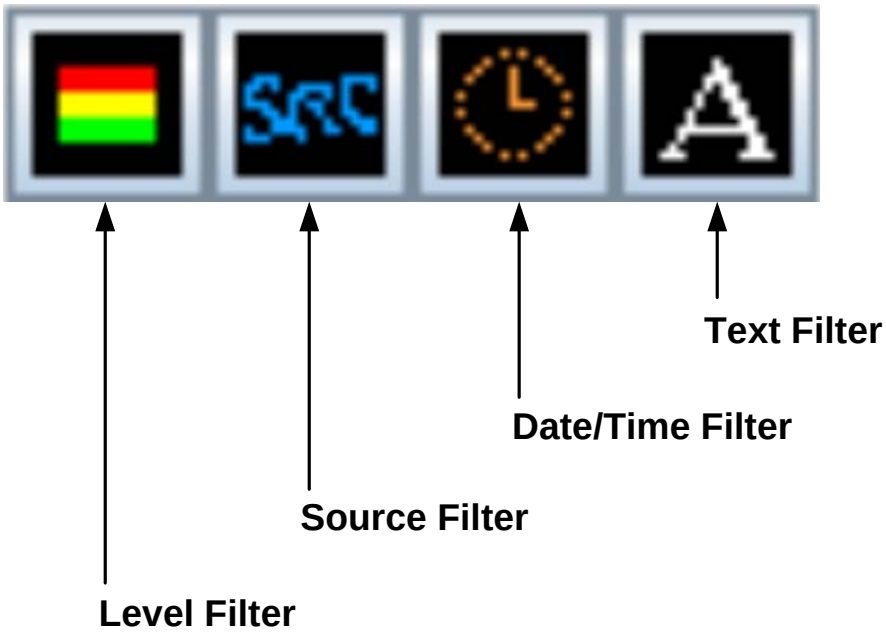


Figure D-6. Message Filters

The "Count" window selects three message scroll ranges. A large value captures more messages but requires more processing time, and makes the scroll bars more sensitive

Messages also include diagnostic backtrace text, which can be displayed by clicking the BackTrace Button in the row displaying the message text. This creates a BackTrace Window containing the expanded text. See Figure D-7.

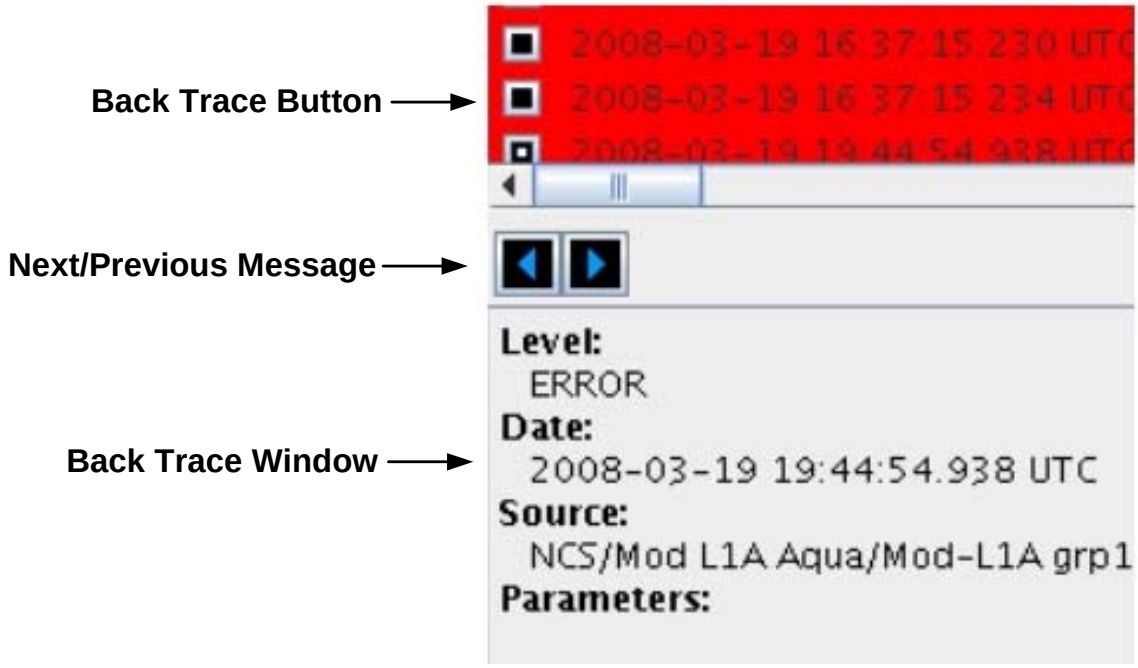


Figure D-7. Back Trace Details

The expanded text can be saved to a file by clicking on the Backtrace Save Button. Clicking on the BackTrace Window Delete Button deletes the backtrace text and restores the original display. See Figure D-8.

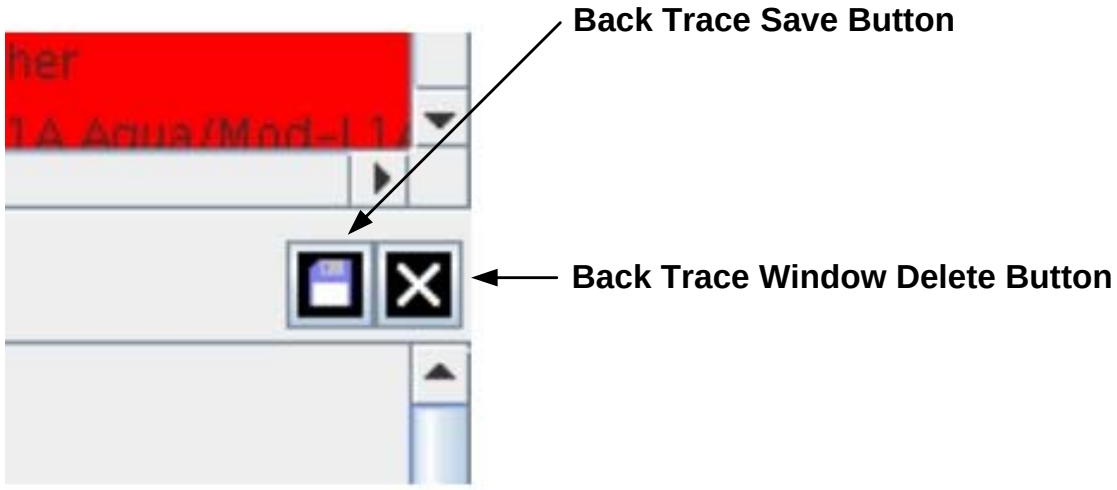


Figure D-8 Back Trace Save and Window Delete Buttons

Appendix E
Description of Science Processing Algorithms (SPAs)

A short description of the Science Processing Algorithms (SPAs) and other software included in this package follows. A more detailed description for some SPAs is contained in PDF documents located in the drl/SPA/*algorithm-name* subdirectories.

Aqua GBAD Ephemeris and Attitude Data Converter (GBAD)
GBAD reads Level-0 APID957 packet files and creates ephemeris and attitude files.

HDF to GeoTIFF (H2G)
The DRL provides the H2G utility for creating geotiff files from HDF products. TIFF viewers and Geographic Information Systems (GISs) can display geotiff files. A list of h2g stations included in this package follows:

aerosols-geotiff
atmprofile-geotiff
chlor_a-geotiff
cloudmask-geotiff
creflrgb-geotiff
fire-geotiff
lst-geotiff
ndvi-geotiff
sst-geotiff
ctp-geotiff
irphase-geotiff
evi-geotiff
sreflrgb-geotiff

International MODIS/AIRS Processing Package (IMAPP)
The IMAPP creates Level-2 MODIS Cloudmask (MOD35), Cloudtop Properties and Cloud Phase (a portion of MOD06) atmospheric products, Atmospheric Profiles (MOD07), and Aerosol (MOD04) from MODIS Aqua and Terra Level-1B DB data.

MODIS Active Fire Product (MOD14)
MOD14 uses brightness temperatures derived from MODIS bands 21, 22 and 31, and MODIS bands 1, 2, 7 and 32 to reject false detection and to mask clouds. The algorithm reads a MODIS 1-km Level-1B file and the associated geolocation file, and generates a two-dimensional fire mask HDF file and optionally creates a text file listing the fire locations.

MODIS Land Surface Temperature (LST)
The LST algorithm uses brightness temperatures in MODIS bands 31 and 32 to produce day and night LST products at 1-km spatial resolutions in swath format.

It uses MODIS Level-1B 1-km and geolocation HDF files and creates LST HDF files.

MODIS Level-1 Direct Broadcast Science Processing Algorithm (MODISL1DB)
MODISL1DB creates the Level-1A MOD01 and MYD01 HDF files, and MOD03 and MYD03 Geolocation products from MODIS Level-0 PDS packet files. Level-1B quarter, half and one kilometer resolution HDF files are created from the Level-1A products.

L2GEN Algorithm (L2GEN)
L2GEN produces MODIS Level-2 Ocean Color (daytime product, including Chlorophyll-a concentration) and Sea Surface Temperature (SST) products from MODIS Level-1B 1km (MOD021KM and MYD021KM) products, MODIS Geolocation (MOD03 and MYD03) products, and other ancillary files.

Normalized Difference Vegetation Index (NDVIEVI)
The Normalized Difference Vegetation Index (NDVI)/Enhanced Vegetation Index (EVI) algorithm uses the three MODIS Level-1B files (1KM, HKM and QKM) and generates NDVI and EVI in a single HDF file. NDVI/EVI is a daytime-only product. The algorithm is applied on corrected reflectances in MODIS bands 1, 2 and 3.

MOD09
The surface reflectance product is an estimate of the surface spectral reflectance for each band as it would have been measured at ground level if there were no atmospheric scattering and absorption.

NOTE: MOD09 is resource-intensive; consideration should be given to system resources and hardware requirements of computers where this SPA is to run.

Appendix F
Information Services (IS) Repository Overview

The Information Services IS-Retriever acquires ancillary files required for product generation from remote sites and stores these files in the local IS Repository Subdirectory. By default, ancillary files are retrieved from the DRL IS Repository. The Information Services IS-Deleter periodically traverses this subdirectory and deletes obsolete products and ancillary files.

IS Subdirectory Overview

All products and ancillary files are copied to the IS Repository. The highest-level subdirectory is /raid/pub. The following overview describes the main subdirectories. Not all subdirectories are currently populated.

/raid/pub/

Subdirectories under /raid/pub are publicly-accessible.

isconfig/

IS-Retriever Configuration Files are stored in the isconfig/ subdirectory. These files are typically copied here by the SPA Installation Script.

ancillary/

Ancillary files required for product generation but not created locally are stored in the ancillary/ subdirectory.

temporal/

This subdirectory contains time-dependent high-level products retrieved from remote sites, e.g. Sea Surface Temperatures, Global Sea Ice Concentration, Total Ozone Analysis, etc.

LUTs/

Instrument Calibration and Lookup Tables (LUTs) retrieved from remote sites are stored here.

ephemeris/

Currently this subdirectory contains the tle/ subdirectory where NORAD Two-Line Element (TLE) Sets are stored.

spatial/

This subdirectory contains static data that are not expected to change (e.g., the World Databank II Map, and the Digital Elevation Map).

/raid/dsm/nisfes_data/

Level-0 packet and CSR files are input to the IPOPP by placing them in this subdirectory. See Appendix C, "Receiver Interface to IPOPP."

FAILED/

Files causing errors during initial processing by PdsMover are placed here.

SLIVERS/

Short files representing pass fragments are placed here.

gsfcdata/

Locally generated Level-0, Level-1 and Level-2 products are stored here in the corresponding spacecraft subdirectories by instrument type.

terra/

aqua/

Appendix G
IPOPP Software Package Overview

A top-level overview of the IPOPP Software Package directory structure is presented in Figure G-1.

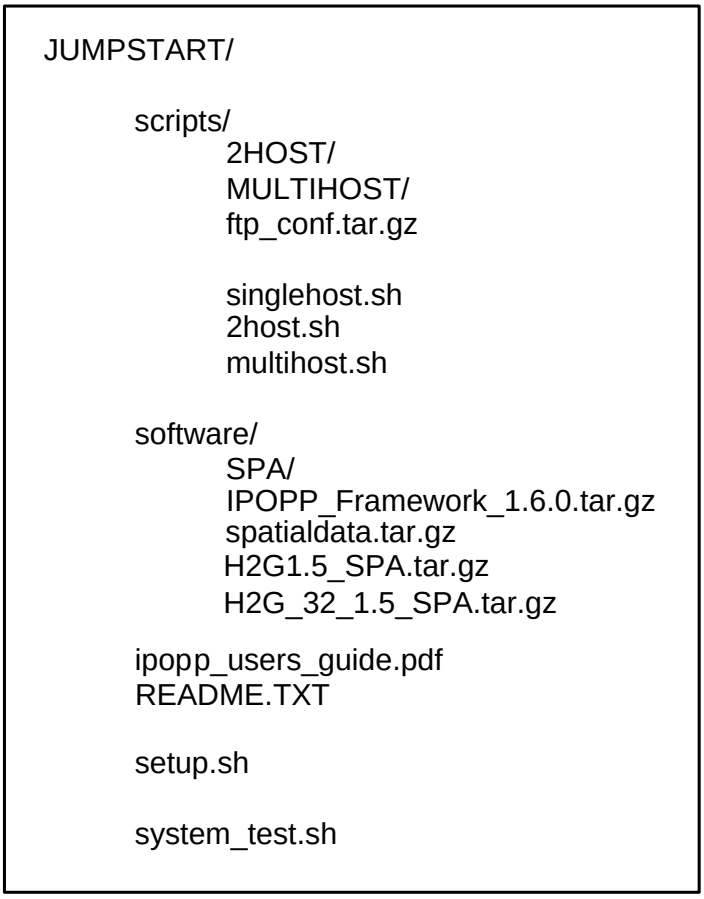


Figure G-1. Top-level IPOPP Software Package Hierarchy

The "scripts" subdirectory contains auxiliary scripts invoked by "setup.sh" when installing multiple-host configurations. This subdirectory also includes a compressed, archived vsftp demon required on the IS host in multiple-host configurations.

The "software" subdirectory contains the SPAs, IPOPP software, and static data. Each SPA is stored as a compressed, archive file in the SPA/ subdirectory. The IPOPP_Framework_n.n.n.tar.gz files contains the software, and the spatialdata.tar.gz file contains static ancillary data, e.g. Digital Elevation Maps.

The ipopp_users_guide.pdf is this user's guide in Adobe PDF format. The README.TXT briefly identifies this package and list DRL contacts.

The system_test.sh tests the host computer against many known software and hardware requirements. These requirements are listed in more detail in Appendix A, "System Requirements".

The "setup.sh" script is the main installation script. It invokes the auxiliary scripts in the "scripts" subdirectory to install the IPOPP in single-host, two-host, or multiple-host configurations. Detailed installation instructions are included in the "IPOPP Operation" section of this guide.

The "setup.sh" script prompts the user to specify whether the host is a 32-bit or 64-bit computer, whether a single-host, two-host, or multiple-host IPOPP is to be installed and, for multiple-host configurations, whether this host is an FES, DS, or IS computer. The script then sets the required links to the Java Service Wrapper shared object libraries and invokes the required auxiliary scripts to complete the installation.